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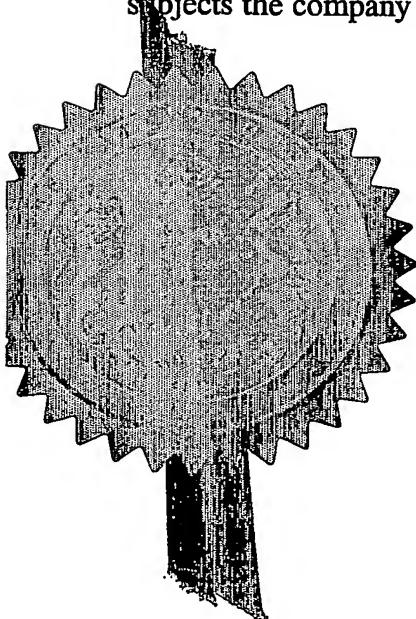
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1. Your reference

Torque Tightening Wrench

2. Patent application number*(The Patent Office will fill in this part)*

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3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

SMART Tools LTD.,

BADGE Power B.,

KIRKTON IND. EST.,

ARBROATH,

ANGUS.

080211022022

))11 3LS

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

Torque Tightening Wrench

5. Name of your agent *(if you have one)**"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)*Nigel BUCHANAN,  
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Description 15

Claim(s) 2

Abstract 1

Drawing(s) 7 + 7 + 7 *Mr*

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Signature *Nicola Buchanan*

Date 7/8/02

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## TORQUE TIGHTENING WRENCH

### FIELD OF THE INVENTION

The present invention relates to wrenches (also known as 'spanners',

5 particularly in the United Kingdom), and in particular to "ring" wrenches.

### BACKGROUND OF THE INVENTION

A Wrench is a tool for applying torque to a nut, bolt, screw or the like

(hereinafter referred to, for convenience, as a "fastener") for the purpose of

10 tightening or slackening the fastener. The wrench has a head portion shaped to engage the periphery of the fastener in a non-rotatable manner such that a force applied to rotate the head transmits torque to the fastener. The fastener generally has a polygonal shape, typically hexagonal or square, and the head of the wrench has a complementary shape and size. The head of a ring wrench is 15 configured to substantially surround the periphery of the fastener.

The following description will refer particularly to wrenches for use with

hexagonal nuts. However, it will be understood that the invention is equally

applicable to wrenches and corresponding nuts having other shapes and to

20 other types of fastener such as bolts and screws.

A conventional ring wrench has a ring-shaped head with a hexagonal shaped inside surface, each section of which can be substantially flat. In use the inside surface of the wrench engages the flat surfaces or corners of the nut to be tightened or slackened. When the head is rotated in the appropriate direction 5 the nut is slackened or tightened as required. However if the nut is undersized, damaged or worn, it is very likely that the head will 'slip' and rotate around the nut instead of properly gripping or engaging the flats or corners of the nut.

A further embodiment of the present invention applies to a ratchet bar tool used for applying torque via an attached square drive and appropriate socket 10 to a nut, bolt or screw (hereinafter referred to a fastener) for the purpose of tightening or slackening the fastener. The ratchet bar is movable relative to the socket in one direction only. Motion between the ratchet bar and the socket in the opposite direction is prevented by a set of angular teeth, which co-operate with a resilient pawl so as to create a locking motion in one 15 direction only and free movement in the opposite direction. This operation of the socket and fastener via a ratchet bar is much more convenient in restrictive situations than the use of a fixed bar operated socket as there is seldom a requirement to remove and reattach the socket operating the fastener.

20 Variations of the ratchet bar are exhaustive. Most mechanisms have more and more locking teeth etc. to allow a smaller angle between drive, reposition and

drive, resulting in mechanisms that whilst the angle between drive and reposition has been substantially reduced so has the amount of torque that can be safely applied to the ratchet bar without failure.

5    Summary of the Invention

It is an object of the present invention to provide an improved wrench with which fasteners that are undersized, damaged or worn can be reliably engaged by the wrench for applying a torque thereto.

10    In accordance with the invention there is provided a wrench having a head portion adapted to engage and apply torque to a fastener, said head portion including a flexible ring portion having an inner working surface for engaging the fastener, such that, when a torque is applied to said head in a predetermined direction, said ring portion closes around said fastener.

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Preferably, said head portion is adapted to engage and apply torque to a fastener, said head portion including a ring member adapted to substantially surround a peripheral surface of a fastener such that, when an inner surface of said ring member engages a fastener and a torque is applied to said head portion in a predetermined direction, said ring member closes around said fastener.

Said wrench further includes converging slots in the head portion which converge towards the ring member and slot pins within the converging slots which are in fixed positions relative to the handle portion. When the said inner surface of said ring member engages said fastener or drive means such as a 5 spigot on a socket drive and said torque is applied to said head portion in said predetermined direction, said fixed cam pins within said converging slots pivoting in the direction of the said torque.

In one example if the said torque is applied in the 'clockwise direction' the said cam pins will also rotate in a clockwise direction within the said 10 converging slots. Viewed from above with the handle portion towards the operator the left hand cam pin is prevented from further travel in a 'clockwise direction' by the left hand converging slots top inner the said pin becoming a fixed pivot point. The 'right hand' cam pin can however travel within the 'right hand' converging slot towards the bottom outer. The consequence of 15 the said cam pin travelling towards the bottom outer is the said ring member closes around the said fastener or drive means until such times as no further closure can be attained. All further turning force applied to the torque tightening wrench is then transmitted directly to the fastener in order to operate the fastener as required.

20 When the torque-tightening wrench is operated in the opposite anti-clockwise direction the said cam pins will also rotate in an anti-clockwise direction

within the said converging slots. Viewed from above with the handle portion towards the operator the 'right hand' cam pin is prevented from further travel in a clockwise direction by the 'right hand' converging slot top inner. The said pin becoming a fixed pivot point. The 'left hand' cam pin being propelled 5 within the 'left hand' converging slot towards the bottom outer. The consequence of the said cam pin travelling towards the bottom outer is the said ring member closes around the fastener or drive means until such times as no further closure can be attained. All further turning force applied to the torque tightening wrench is then transmitted directly to the fastener or drive 10 means in order to operate the fastener or drive means as required.

### Description of the embodiments

Specific embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

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Figure 1a shows in perspective the torque-tightening wrench wherein the head portions are preferably stacked on the top of each other in order to provide a range of wrenches in a convenient package.

10 Figure 1b illustrates in perspective the torque-tightening wrench with one head portion on each end of the handle portion.

Figure 2a shows a side view of the torque-tightening wrench wherein the head portions are preferably conveniently stacked on the top of each other.

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Figure 2b illustrates a side view of the torque-tightening wrench.

Figure 3a illustrates a top view of the torque-tightening wrench engaging a fastener in the clockwise © drive (D) direction.

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Figure 3b shows a top view of the torque-tightening wrench at rest.

Figure 3c shows a top view of the torque-tightening wrench engaging a fastener in an anti-clockwise (A) drive (D) direction.

5 Figure 4a illustrates a top view if the torque tightening wrench wherein circular drive sockets are within the circular inner ring. The bottom head portion is shown biased in the anti-clockwise (A) drive (D) direction.

10 Figure 4b illustrates a top view of a torque-tightening wrench wherein the drive portions have square drives.

Figure 4c shows a top view of a torque-tightening wrench wherein circular drive sockets are within the circular inner ring. The bottom head portion is shown biased in the clockwise (C) drive (D) direction.

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Figure 5a illustrates a top sectioned view of the torque-tightening wrench as in Fig 4a.

20 Figure 5b illustrates a top sectioned view of the torque-tightening wrench as in Fig 4b.

Figure 5c shows a top sectioned view of the torque-tightening wrench as in Fig 4c.

Figure 6a shows a sectioned perspective view of the torque-tightening wrench as in Fig 3a.

Figure 6b shows a sectioned perspective view of the torque-tightening wrench as in Fig 3b.

10 Figure 6c illustrates a sectioned perspective view of the torque-tightening wrench as in Fig 3a.

Figure 7 illustrates the torque-tightening wrench wherein circular drive sockets are within the circular inner ring. A fastener is shown within a drive 15 socket. The torque-tightening wrench is biased by the use of thumb and finger grip. A circular drive socket is shown separately with its circular drive portion exposed.

## REFERENCE TO THE DRAWINGS

With reference to the accompanying drawings the following numbers relate to the following features:

(1)	Torque tightening wrench	(4c)	Head Slot
(2)	Head portion	(5)	Connecting plates
(2a)	Resilient ring member	(6)	Fastener
(2b)	Converging slots	(7)	Circular drive portion
(2c)	Top cam surface	(7a)	Circular drive socket
(2d)	Bottom cam surface	(7b)	Circular drive recess
(2e)	Elongate member	(7c)	Circular drive retaining ring
(2f)	Torque gap	(7d)	Circular drive square drives
(2g)	Polygonal inner surface	(8)	Resilient cam
(2h)	Ring segments	(8a)	Spring
(2i)	Concave corner hinges	(8b)	Ball
(2j)	Circular inner ring	(9a)	Thumb
(2k)	Bias profile	(9b)	Fingers
(3a)	Slot cam pins	(A)	Anti-clockwise direction
(3b)	Handle pins	(C)	Clockwise direction
(4)	Handle portion	(D)	Drive
(4a)	Handle cover grip	(R)	Reverse or reposition
(4b)	Resilient cam recess		

REFERENCE TO THE DRAWINGS

5 Referring to the drawings the torque tightening wrench (1) comprises a head portion (2) with a resilient ring member (2a) with converging slots (2b) with top cam surfaces (2c) nearest the resilient ring member (2a) and bottom cam surface (2d) within the elongate members (2e). The open resilient ring member (2a) has a torque gap (2f) within the resilient ring member (2a) and in  
10 one example a polygonal inner surface (2g) with ring segments (2h) joined by concave corner hinges (2i). At rest, the slot cam pins (3a) are preferably against the top cam surfaces.

When the torque tightening wrench (1) engages a fastener (6) and torque arm force is applied to the handle portion (4) in a predetermined drive (D) direction (either clockwise (C) or anti-clockwise (A)) the head portion (2) polygonal inner surface (2g) grips the fastener (6) by its like surfaces. The slot cam pins (3a) affixed to the handle portion (4) rotate in the like direction of the torque arm force. As one slot cam pin (3a) can no longer rotate within its  
20 converging slot as it has attained full movement against its top cam surface it becomes a fixed point around which the head portion (2) can pivot. Whereas,

the other slot cam pin (3c) can, according to the torque arm force applied, travel outwards from the resilient ring member (2a) towards the bottom cam surface (2d) causing the resilient ring member (2a) and its polygonal inner surface (2g) to close around the fastener (6) providing superior grip to the 5 nearsized, undersized, worn or damaged fasteners (6) allowing a far greater range of fasteners (6) to be appropriately tightened or slackened as required. The head portion (2) can rotate horizontally relative to the handle portion (4) within the confines of the head portion slot (4c) or connecting plates (5) fixed to the handle portion (4) by the handle pins (3a) a handle cover grip (4a) can 10 be usefully provided to improve comfort during use.

In a further embodiment of the present invention, the resilient ring member (2a) has a circular inner ring (2j) for the engagement of a resilient gripped circular drive portion (7) which can conveniently drive directly or otherwise 15 various known sockets or fastener (6) drives or circular drive square drives (7d). A circular drive socket (7a) preferably has a circular drive recess (7b) or retaining ring (7c). In one example, the head portion (2) is preferably first biased in the drive (D) direction the preferably resilient cam (8) ball (8b) is sprung by a spring (8a) from the resilient cam recess (4b) against the bias 20 profile (2k) on the elongate member (2e). The bias imparted by the resilient cam (8) acting predominantly against the elongate member (2e) containing the

non-pivotal slot cam pin (3a). The resilient cam (8) and the resilient ring member (2a) with the circular inner ring (2j) import a resilient grip on the drive portion (7). In the drive (D) direction the grip between the circular inner ring (2j) and the drive portion (7) is virtually instant. When the handle portion (4) is operated in the reverse or reposition (R) direction the applied torque arm force acts against the resilient cam (8) and the resilient grip applied by the resilient ring member (2a) substantially decreasing the degree of clamping between the circular inner ring (2j) and the drive portion (7) enabling the head portion (2) to easily rotate, reverse or reposition (R) relative to the drive portion (7). The drive portion (7) can conveniently form part of a circular drive socket (7a) which preferably has a circular drive recess (7b) or a circular drive retaining ring (7c).

In use the Torque Tightening Wrench (1) head portion (2) engages the fastener (6) or circular drive means (7) to be operated. In the first example the polygonal inner surface (2g) engaging the like sized and shaped fastener (6). In the second example the circular inner ring (2j) engaging the drive portion (7). The slot cam pins (3a) fixed to the handle portion (4) initial position is preferably against the top of the converging slots (2b), the top cam surface (2c). As torque arm force is applied to the handle portion (4) the slot cam pins (3a) rotate in the same direction as the force applied to the handle portion (4).

As only one or other of the slot cam pins (3a) according to the direction of applied force (clockwise (C) or anti-clockwise A) is capable of movement within the converging slots (2b) the static slot cam pin (3a) becomes a pivot point. The progress of the disposition of the moveable slot cam pin (3a) up

5 the incline of the further converging slot (2b) causing the elongate members (2e) to be drawn together to close the torque gap (2f) according to the torque arm force applied and the amount the resilient ring member (2a) closes around the fastener (6) or circular drive portion (7) until such times as no further closure can be attained. All further torque arm force applied to the

10 torque tightening wrench (1) is then usefully transmitted directly to the fastener (6) or circular drive portion (7) in order to tighten or slacken the fastener (6) according to the direction of force. The first example of the torque tightening wrench (1) whereas the head portion (2) has ring segments (2h) defining a generally polygonal inner surface (2g) although not a complete

15 ring the ring segments (2h) are formed integrally with one another and adapted to deform resiliently at the concave corner hinges (2I) between adjacent, integrally formed ring segments (2h) allowing the resilient ring member (2a) to close around the fastener (6). As torque is applied usefully enhancing the grip on worn or undersized fasteners (6).

20 In the second example of the torque tightening wrench (1) the resilient ring member (2a) has a circular inner ring (2J) which has a resilient grip on a

complementary circular drive portion (7). The circular drive portion (7) can take the form of removable circular drive sockets (7a) retained circular drive sockets (7a) or square drives (7d) or any combination. Instant grip can be imported on the circular drive portion (7) in the drive (D) direction by 5 gripping the handle portion (4) appropriately by the hand whereas the thumb (9a) is placed as a pivotal point near the head portion(2) and the fingers (9b) import the main torque arm force. In the reverse (R) direction the pivotal action of the thumb (9a) is lessened. The circular drive portion (7) then being easily reversed or repositioned.

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### Abstract

### **Torque Tightening Wrench**

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The fastener (6) is engaged by the polygonal inner surface (2g) of the resilient ring member (2a) or circular drive portion (7). As force is applied to the handle portion (4) in the required direction slot cam pins (3a) fixed to the handle portion (4) rotate accordingly within converging slots (2b) within the head portion (2) elongate members (2e), causing the elongate members to be drawn together closing the resilient ring member (2a) around the fastener (6) or circular drive portion (7) until no further closure can be attained. All further force is then usefully transmitted to the fastener (6) in order to tighten or slacken the fastener (6) as required.

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In use the wrench (1) resilient ring member (2a) and its polygonal inner surface (2g) closes around the fastener (6) providing superior grip to nearsized, worn or damaged fasteners and if the head portions (2) are stacked on top of each other a range of both metric and inch wrenches can be provided in a more convenient package.

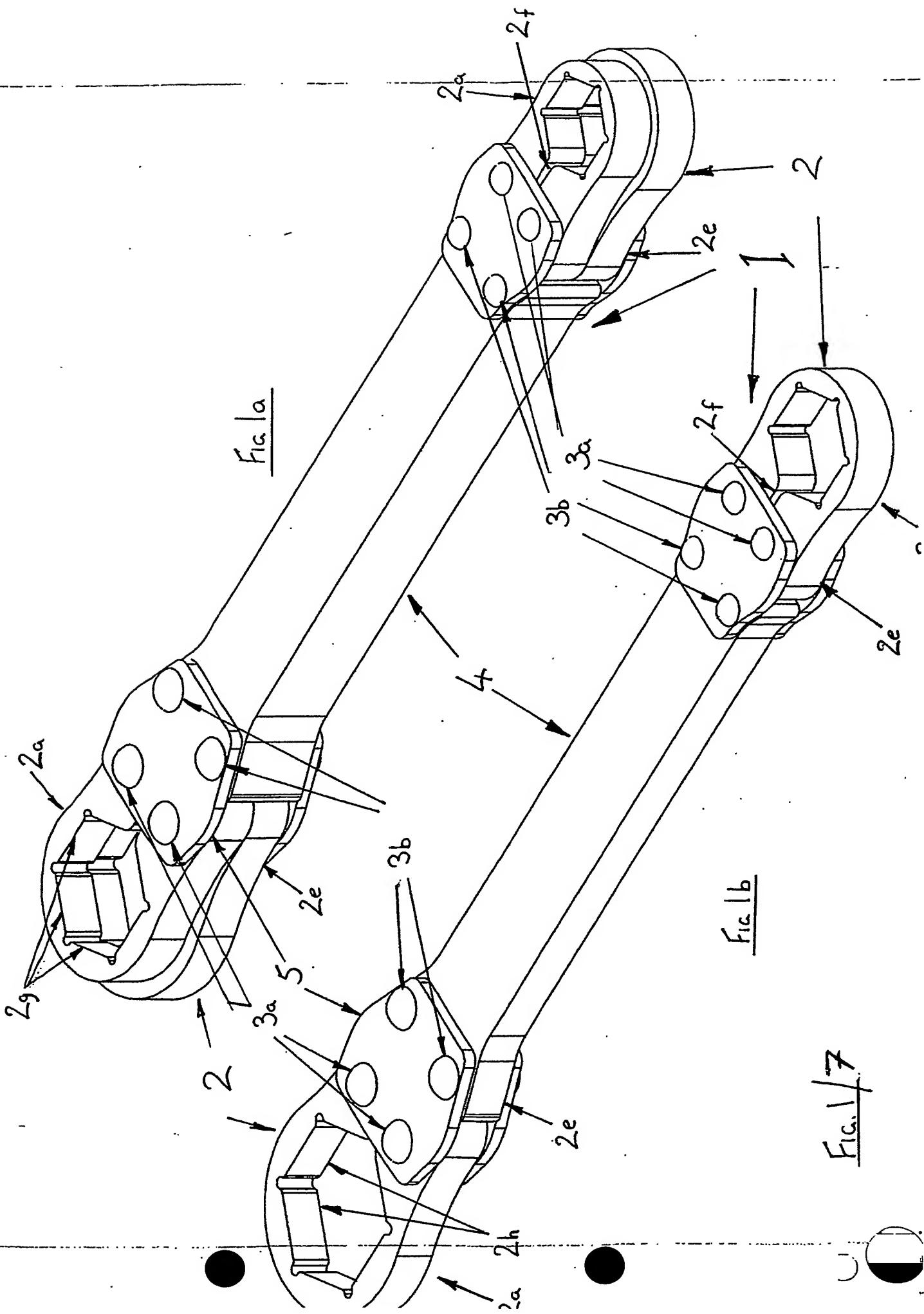
### Claims

Claim 1 The Torque Tightening Wrench (1) head portion (2) engages the fastener (6) or circular drive means (7) to be operated. In the first example the polygonal inner surface (2g) engaging the like sized and shaped fastener (6). In the second example the circular inner ring (2j) engaging the drive portion (7). The slot cam pins (3a) fixed to the handle portion (4) initial position is preferably against the top of the converging slots (2b), the top cam surface (2c). As torque arm force is applied to the handle portion (4) the slot cam pins (3a) rotate in the same direction as the force applied to the handle portion (4). As only one or other of the slot cam pins (3a) according to the direction of applied force (clockwise (C) or anti-clockwise A) is capable of further movement within the converging slots (2b) the static slot cam pin (3a) 15 becomes a pivot point. The progress of the disposition of the moveable slot cam pin (3a) up the incline of the further converging slot (2b) causing the elongate members (2e) to be drawn together to close the torque gap (2f) according to the torque arm force applied and the amount the resilient ring member (2a) closes around the fastener (6) or circular drive portion (7) until 20 such times as no further closure can be attained. All further torque arm force applied to the torque tightening wrench (1) is then usefully transmitted

directly to the fastener (6) or circular drive portion (7) in order to tighten or slacken the fastener (6) according to the direction of force. The first example of the torque tightening wrench (1) whereas the head portion (2) has ring segments (2h) defining a generally polygonal inner surface (2g) although not a

5 complete ring the ring segments (2h) are formed integrally with one another and adapted to deform resiliently at the concave corner hinges (2I) between adjacent, integrally formed ring segments (2h) allowing the resilient ring member (2a) to close around the fastener (6). As torque is applied usefully enhancing the grip on worn or undersized fasteners (6).

10 In the second example of the torque tightening wrench (1) the resilient ring member (2a) has a circular inner ring (2J) which has a resilient grip on a complementary circular drive portion (7). The circular drive portion(7) can take the form of removable circular drive sockets (7a) retained circular drive sockets (7a) or square drives (7d) or any combination.



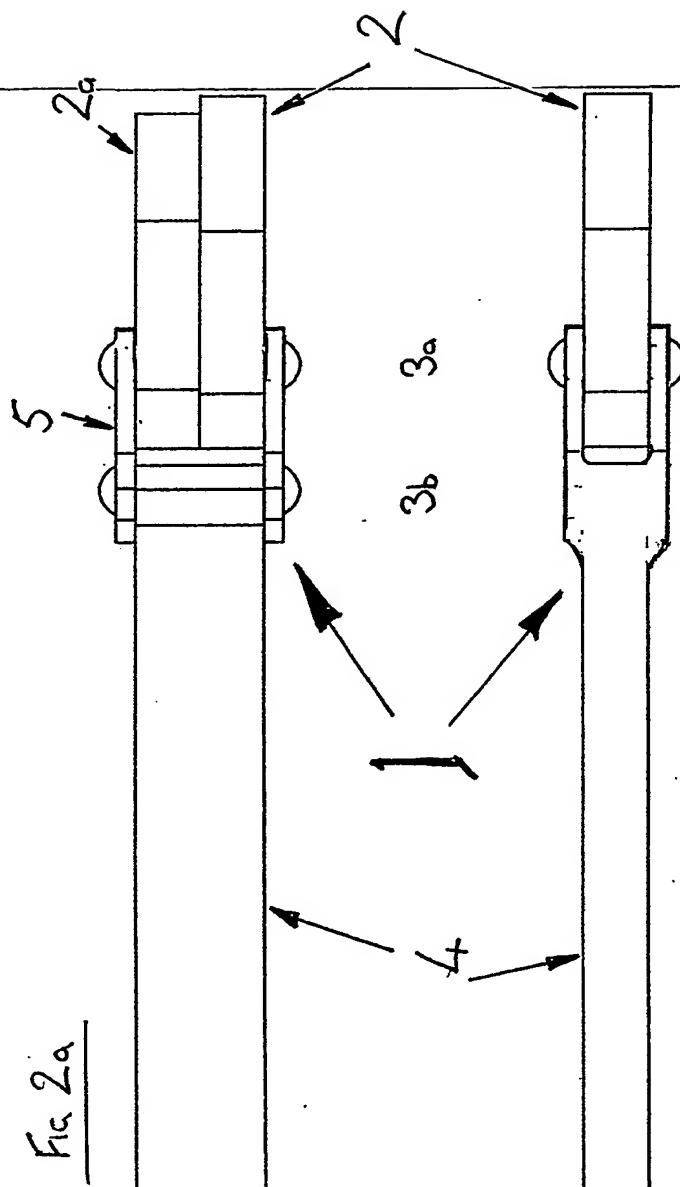
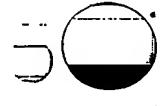
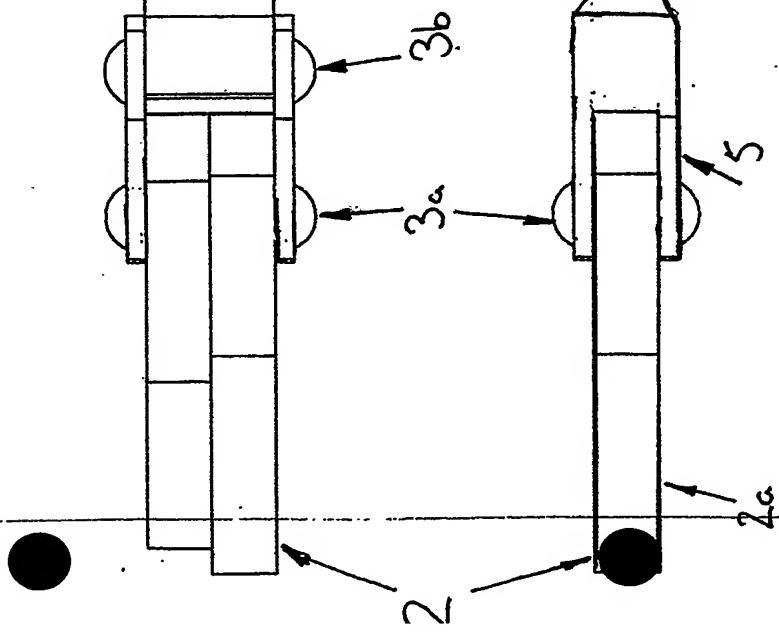
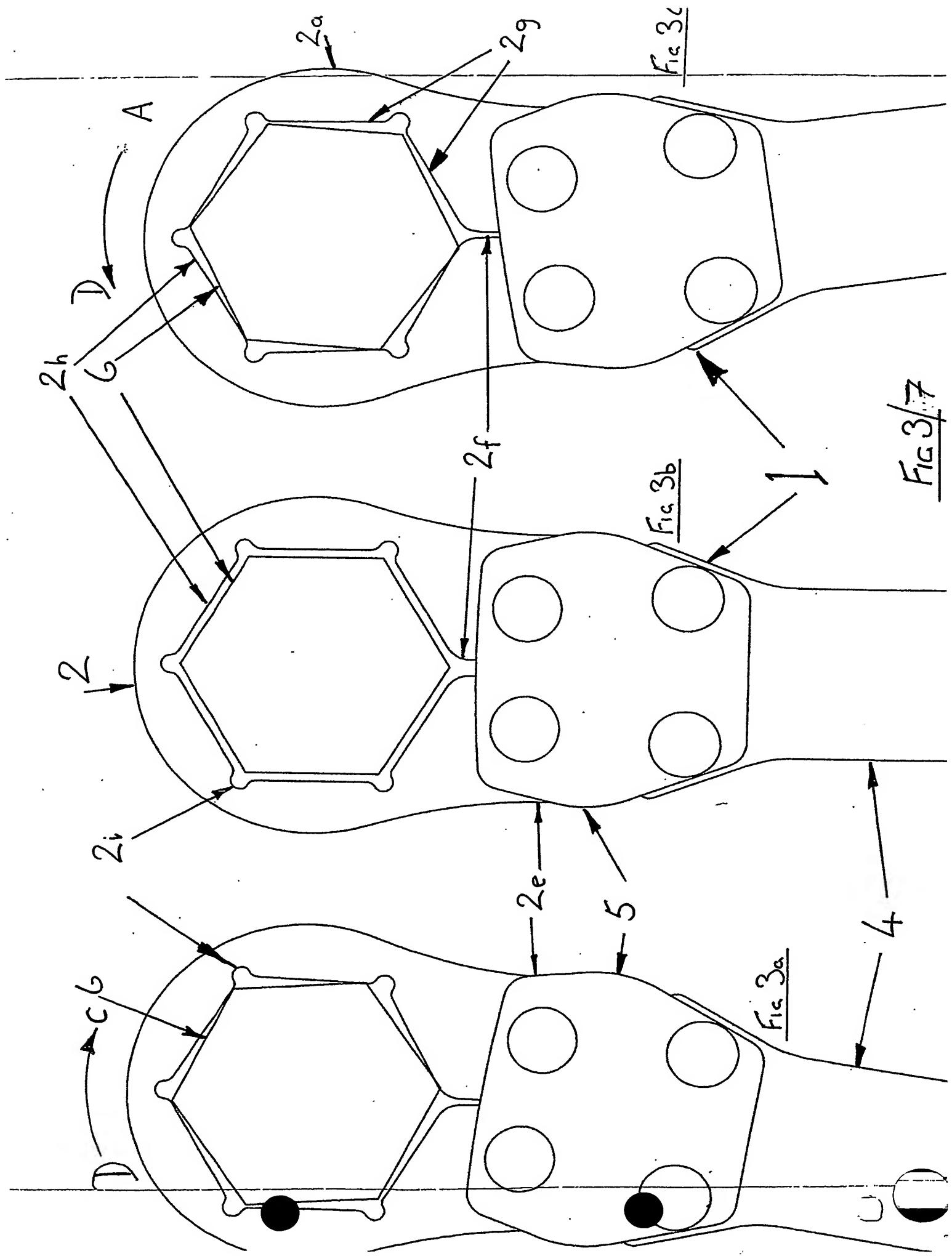


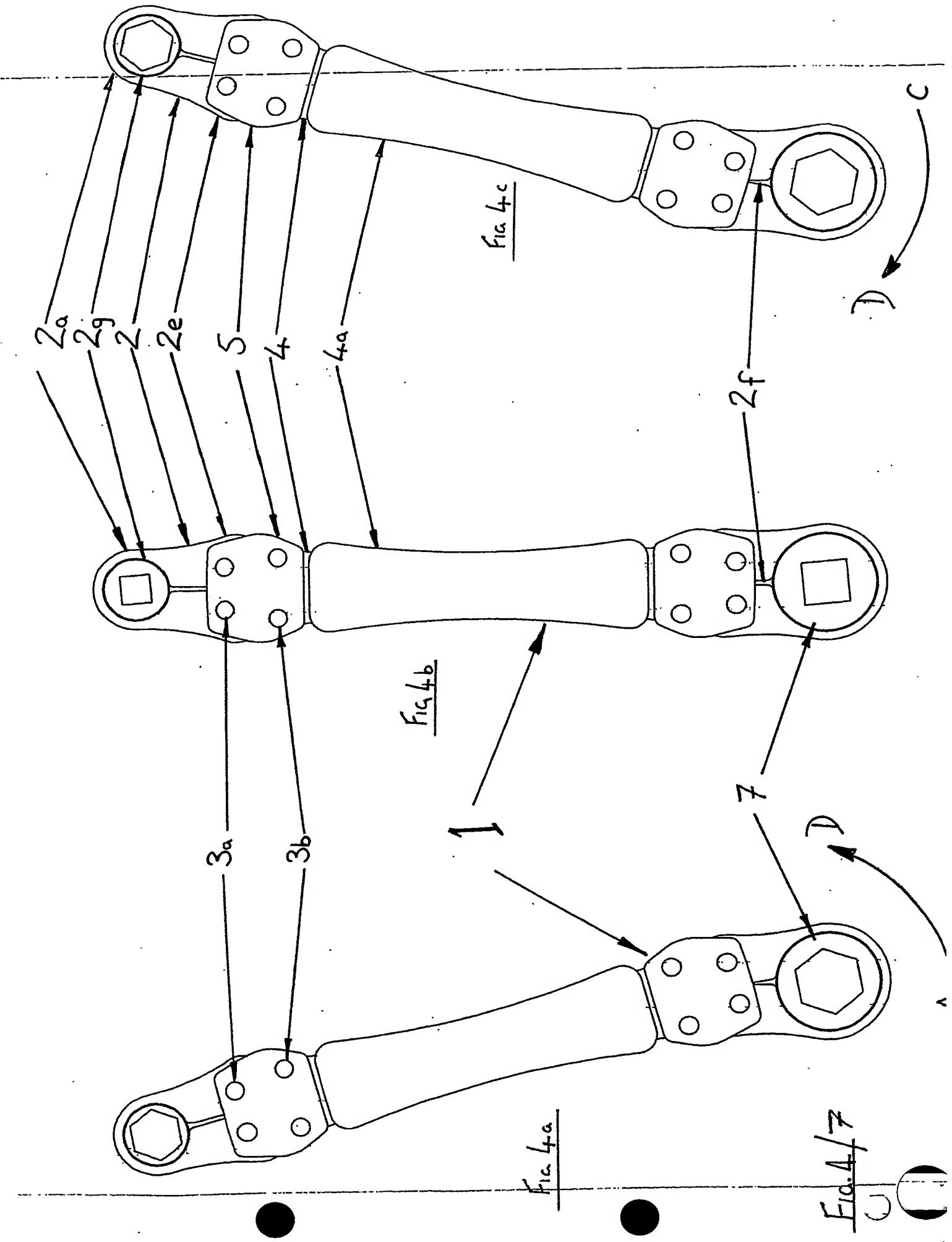
Fig. 2a

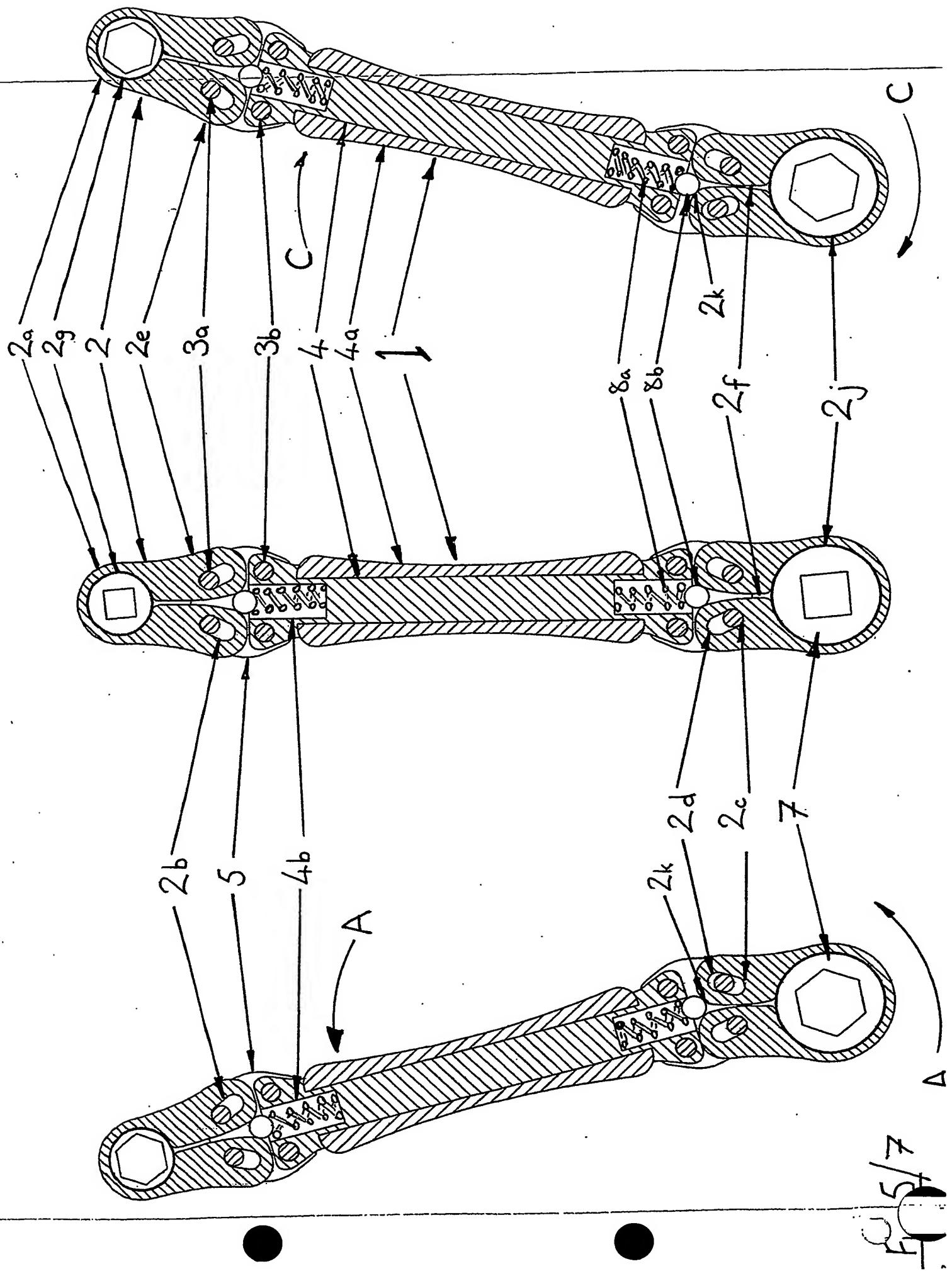
Fig. 2b

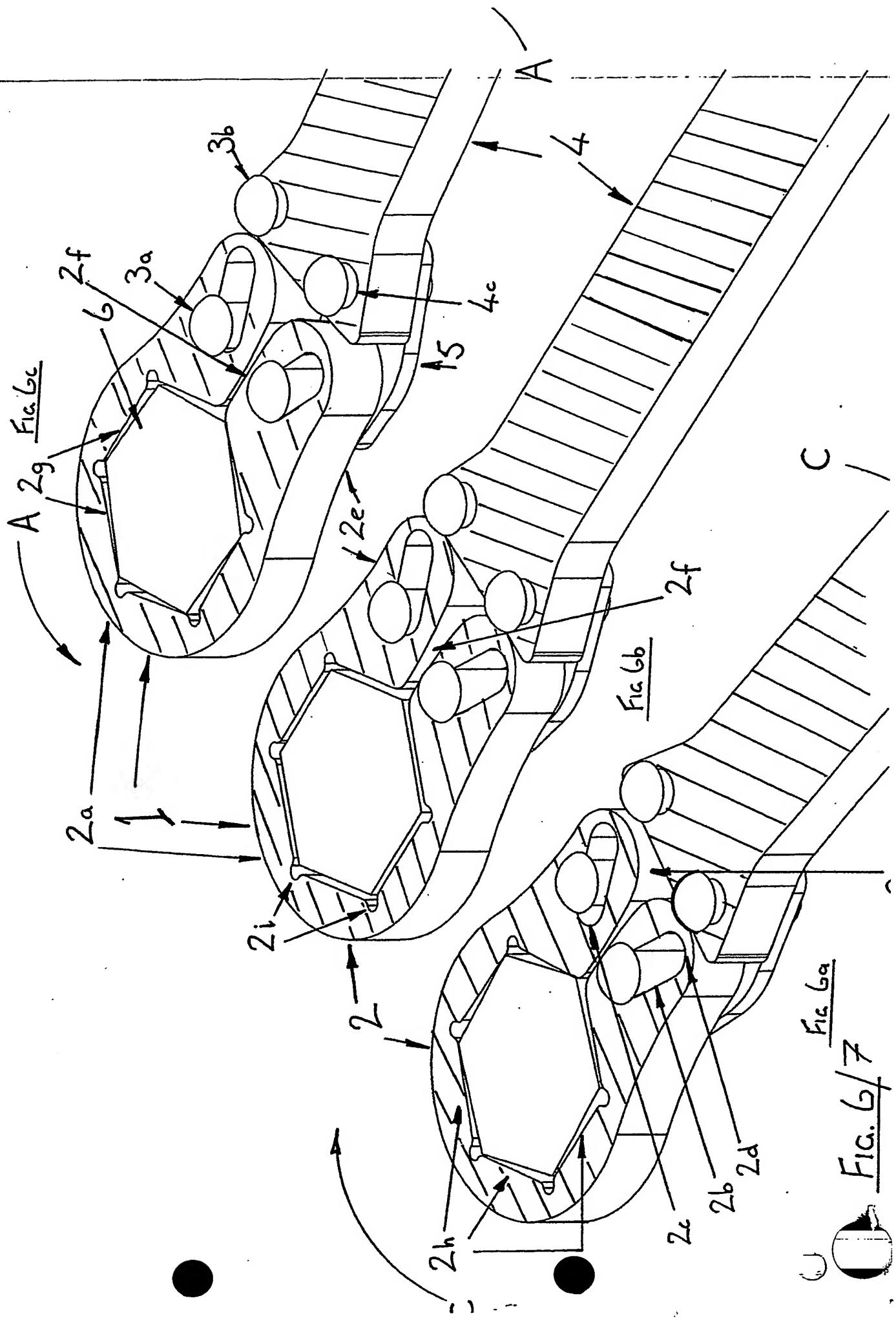
Fig. 2/7

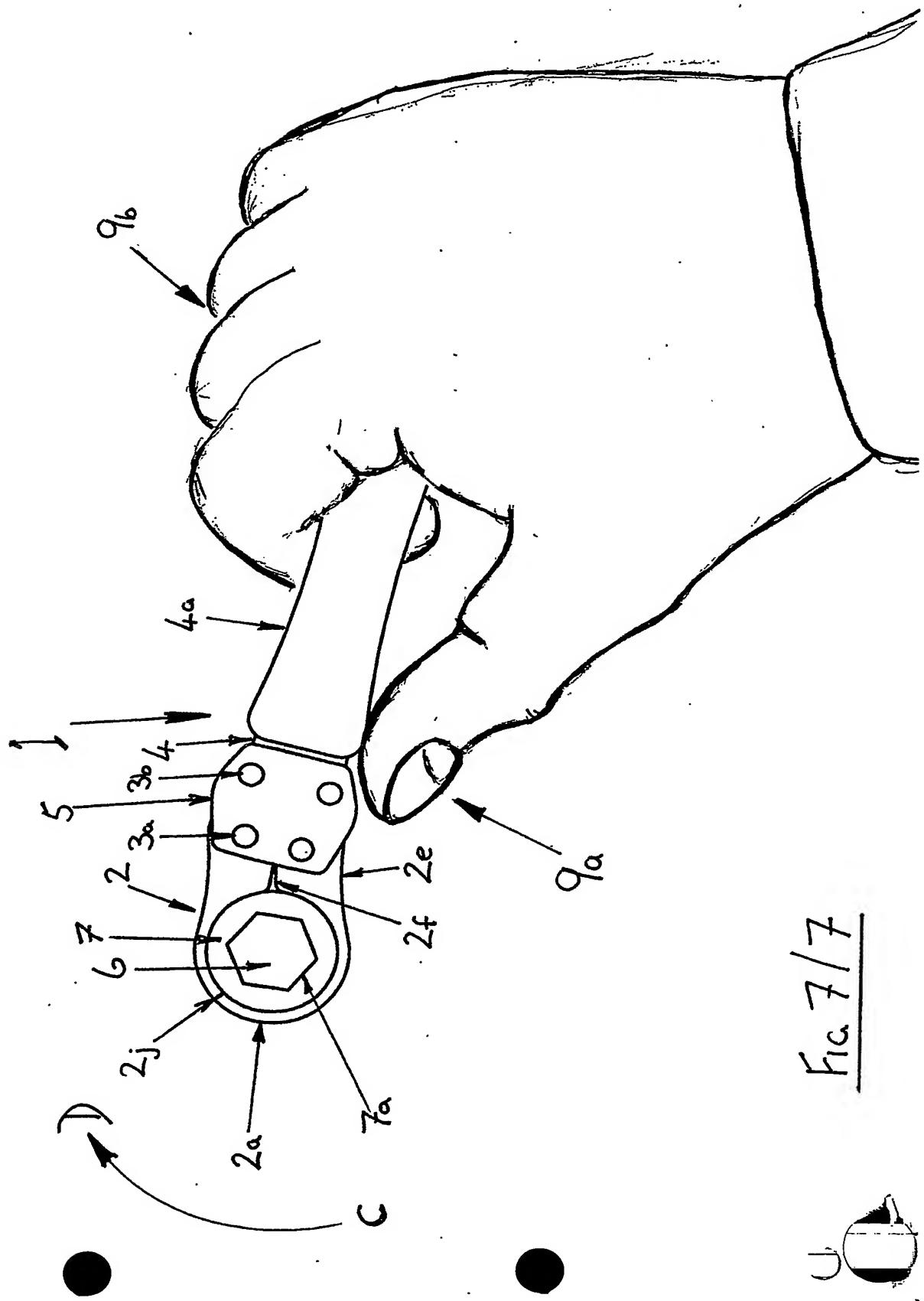












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